CLAIMS

1. A bonding method using a universal solder comprising:

disposing a first device comprising a contact pad within a vacuum chamber having a vacuum pressure;

placing a universal solder preform on the contact pad;

arranging a second device comprising a surface to be bonded within the vacuum chamber such that the surface to be bonded is aligned with the universal solder preform; and

pressing the second device onto the solder preform thereby forming a solder joint between the surface to be bonded and the first device.

2. The method of claim 1, wherein the vacuum pressure is 10^{-6} torr or less.

3. The method of claim 1, wherein the vacuum pressure is 10^{-7} torr or less.

4. The method of claim 1, wherein the vacuum pressure is 5×10^{-8} torr or less.

5. The method of claim 1 further comprising depositing a resistive heating element on a surface of at least one of the first or second devices for heating the universal solder preform.

6. The method of claim 1, wherein the solder joint is a hermetic seal.

7. The method of claim 1, wherein the universal solder preform is a bulk solder or thin film deposited solder.

8. The method of claim 1, wherein the first device is a substrate.

9. The method of claim 1, wherein at least one of the first and second devices comprises an electronic circuit device.

10. The method of claim 1, wherein at least one of the first and second devices comprises a microelectromechanical system device.

11. The method of claim 1, wherein at least one of the first and second devices comprises an optical device.

12. The method of claim 1, wherein the surface to be bonded comprises a material selected from the group consisting of oxides, nitrides, fluorides, sulfides, carbides, semiconductors, selenides, silicon, GaAs, GaN and diamonds.

13. A bonding method using a universal solder comprising:

coating at least a portion of a heated metal brush with a molten universal solder;

passing the brush with the molten universal solder over a first device thereby coating at least a portion of the first device with a layer of the molten universal solder; and

pressing a second device onto the layer of molten universal solder thereby forming a solder joint between the first device and the second device, wherein a time from the coating of the at least a portion of the first device to the formation of the solder joint is less than or equal to one minute.

14. The method of claim 13, wherein the time from the coating of the at least a portion of the first device to the formation of the solder joint is less than or equal to ten seconds.

15. The method of claim 13, wherein the formation of the solder joint takes place prior to surface oxidation of the molten universal solder.

16. The method of claim 13, wherein the bonding method is conducted in an inert gas atmosphere.

17. The method of claim 13 further comprising cooling of the solder joint to initiate solidification.

18. The method of claim 13 further comprising using a metallic knife to trail the heated metal brush and level off the molten universal solder layer to produce a uniform layer thickness.

19. The method of claim 13, wherein the first device is a substrate.

20. The method of claim 13, wherein at least one of the first and second devices comprises an electronic circuit device.

21. The method of claim 13, wherein at least one of the first and second devices comprises a microelectromechanical system device.

22. The method of claim 13, wherein at least one of the first and second devices comprises an optical device.

23. The method of claim 13, wherein the second device comprises a material selected from the group consisting of oxides, nitrides, fluorides, sulfides, carbides, semiconductors, selenides, silicon, GaAs, GaN and diamonds.

24. The method of claim 13, wherein the first device comprises a hermetic seal pad.

25. The method of claim 24, wherein the hermetic seal pad is pre-heated.

26. A bonding method using a universal solder comprising:

providing a first device spaced apart from a second device, wherein a space between the first device and the second device forms a joint area;

placing a universal solder preform in the joint area;

melting the universal solder preform, wherein an oxide skin is formed on a surface of the molten universal solder preform; and

pressing the second device toward the first device to collapse the molten universal solder and create a mechanical disturbance of the oxide skin, thereby

allowing fresh molten universal solder to form a solder joint between the first and second devices.

27. The method of claim 26 further comprising introducing a spacer bump in the joint area to pre-set a thickness of the collapsed universal solder in the joint area.

28. The method of claim 26 further comprising depositing a resistive heating element on a surface of at least one of the first or second devices for heating the universal solder preform.

29. The method of claim 26, wherein at least one of the first and second devices comprises an electronic circuit device.

30. The method of claim 26, wherein at least one of the first and second devices comprises a microelectromechanical system device.

31. The method of claim 26, wherein at least one of the first and second devices comprises an optical device.

32. An article comprising:

a first device; and

a second device bonded to the first device by a universal solder bond, wherein the universal solder bond is formed by disposing the first device comprising a contact pad within a vacuum chamber having a vacuum pressure, placing a universal solder preform on the contact pad, arranging the second device comprising a surface to be bonded within the vacuum chamber such that the surface to be bonded is aligned with the universal solder preform, and pressing the second device onto the solder preform.

33. The article of claim 32, wherein at least one of the first and second devices comprises an electronic circuit device.

34. The article of claim 32, wherein at least one of the first and second devices comprises a microelectromechanical system.

35. The article of claim 34, wherein the microelectromechanical system comprises an optical microelectromechanical system device.

36. The article of claim 32, wherein the first device comprises an elastically pre-strained fiber grating and the second device comprises a material and structure exhibiting a negative coefficient of thermal expansion.

37. The article of claim 32, wherein at least one of the first and second devices comprises an optical fiber device.

38. The article of claim 37, wherein the optical fiber device comprises an optical fiber grating.

39. An article comprising:

a first device; and

a second device bonded to the first device by a universal solder bond, wherein the universal solder bond is formed by coating at least a portion of a heated metal brush with a molten universal solder, pressing a second device onto the layer of molten universal solder thereby forming a solder joint between the first device and the second device, wherein a time from the coating of the at least a portion of the first device to the formation of the solder joint is less than or equal to one minute.

40. The article of claim 39, wherein at least one of the first and second devices comprises a microelectromechanical system.

41. The article of claim 40, wherein the microelectromechanical system comprises an optical microelectromechanical system device.

42. The article of claim 39, wherein at least one of the first and second devices comprises an electronic circuit device.

43. The article of claim 39, wherein at least one of the first and second devices comprises an optical fiber device.

44. The article of claim 43, wherein the optical fiber device comprises an optical fiber grating.

45. The article of claim 39, wherein the first device comprises an elastically pre-strained fiber grating and the second device comprises a material and structure exhibiting a negative coefficient of thermal expansion.

46. An article comprising:

a first device; and

a second device bonded to the first device by a universal solder bond, wherein the universal solder bond is formed by:

providing the first device spaced apart from the second device, wherein a space between the first device and the second device forms a joint area,

placing a universal solder preform in the joint area, melting the universal solder preform, wherein an oxide skin is formed on a surface of the molten universal solder preform, and

pressing the second device toward the first device to collapse the molten universal solder and create a mechanical disturbance of the oxide skin thereby allowing fresh molten universal solder to form a solder joint between the first and second devices.

47. The article of claim 46, wherein at least one of the first and second devices comprises a microelectromechanical system.

48. The article of claim 47, wherein the microelectromechanical system comprises an optical microelectromechanical system device.

49. The article of claim 46, wherein at least one of the first and second devices comprises an electronic circuit device.

50. The article of claim 46, wherein at least one of the first and second devices comprises an optical fiber device.

51. The article of claim 50, wherein the optical fiber device comprises an optical fiber grating.

52. The article of claim 46, wherein the first device comprises an elastically pre-strained fiber grating and the second device comprises a material and structure exhibiting a negative coefficient of thermal expansion.

53. A method of brazing or bonding two or more articles comprising:

providing two or more articles comprising bonding surfaces;

disposing a solder body between the bonding surfaces;

wetting the bonding surfaces with the solder body under substantially oxygen-free conditions; and

bonding the bonding surfaces under substantially oxygen-free conditions.

54. The method of claim 53, wherein the solder body comprises a universal solder or braze.

55. The method of claim 54, wherein the universal solder comprises a simple alloyed universal solder.

56. The method of claim 53, wherein the solder body comprises a rare earth element buried within the solder body.

57. The method of claim 53, wherein the solder body comprises a universal solder core covered with a noble metal film.

58. The method of claim 53, wherein the solder body comprises a universal solder core and a regular solder jacket.

59. The method of claim 53, wherein the solder body comprises a universal solder paste.

60. The method of claim 59, wherein the universal solder paste comprises solder particles in a paste matrix.

61. The method of claim 60, wherein the solder particles comprise universal solder particles coated with a noble metal.

62. The method of claim 53, wherein one or more of the bonding surfaces comprises a stable inorganic surface.

63. The method of claim 62, wherein the stable inorganic surface comprises a semiconductor.

64. The method of claim 62, wherein the stable inorganic surface comprises a material selected from the group consisting of oxide, nitride, selenide, silicon, GaAs, GaN, fluoride diamond or stable metal.